Contribution ID: **215** Type: **Oral presentation (young scientists)**

Gusts in the Headwind: Uncertainties in Direct Dark Matter Detection

Monday 18 July 2022 18:10 (10 minutes)

A powerful signature for confirmation of a dark matter discovery is an annual modulation in the event rate of collisions in direct detection experiments. It is however unclear how substructure within the dark matter halo might impact this signal. High resolution, hydrodynamic, galaxy simulations from the FIRE collaboration's Latte suite are used to investigate the inherent variation of dark matter around the Solar Circle of a Milky Way-type analogue galaxy. Simulations show the baryonic back-reaction, as well as assembly history of substructures, have lasting impacts on the dark matter's spatial and velocity distributions, creating 'gusts'of dark matter wind around the Solar Circle, potentially complicating interpretations of direct detection experiments on Earth.

The velocity distributions of dark matter are noticeably non-Maxwellian, indicative of fast-moving substructure in the solar neighbourhood, unlike traditional distributions frequently assumed in the literature. Implementing a new numerical integration technique, our work generates bespoke predictions for terrestrial underground detection, finding large uncertainties arising in the expected signals of direct detection experiments. This implies that some metrics for annual modulation signals cannot be tightly constrained, due to the diverse nature of the intrinsic astrophysical inputs. Having developed a realistic end-to-end pipeline for studying these effects, we discuss the implications of these astrophysical variations in the dark matter distribution of the solar neighbourhood on current and future particle physics searches for dark matter.

-Lawrence et al., 2022 (submitted).

Author: LAWRENCE, Grace

Co-authors: Prof. DUFFY, Alan (Swinburne University of Technology); Prof. BLAKE, Chris (Swinburne University of Technology); Prof. HOPKINS, Philip (California Institute of Technology)

Presenter: LAWRENCE, Grace

Session Classification: Parallel 1A - Direct detection I